

# 10 Appendix A: Emission Factors

This appendix lists the emission factors for various fuel combustion modules that were used throughout this project. Most of the emission factors were obtained from the EPA document, “Compilation Of Air Pollutant Emission Factors,” Volume I, Fifth Edition, Point Sources AP-42, which were recompiled for a project done by Argonne National Laboratory (Argonne 1996) as follows:

**Table 142: Emission Factors for Natural Gas Combustion in an Industrial Boiler**

Boiler Type	Emission Factors (g/MJ natural gas fired)							
	Hydrocarbons	CO	NO <sub>x</sub>	PM10	SO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub>
Utility/Industrial Boiler	$6.5 \times 10^{-4}$	0.019	0.086	0.0014	$2.9 \times 10^{-4}$	$1.3 \times 10^{-4}$	$2.0 \times 10^{-4}$	56.6

**Table 143: Emission Factors for Natural Gas Combustion in a Turbine**

Turbine Type	Emission Factors (g/MJ natural gas fired)							
	Hydrocarbons	CO	NO <sub>x</sub>	PM10	SO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub>
Large Gas Turbine	0.0014	0.069	0.052	$9.7 \times 10^{-4}$	$2.9 \times 10^{-4}$	0.0046	0.0019	56.5

**Table 144: Emission Factors for LPG Combustion in an Industrial Boiler**

Boiler Type	Emission Factors (g/MJ LPG fired)							
	Hydrocarbons	CO	NO <sub>x</sub>	PM10	SO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub>
Industrial Boiler	0.0022	0.016	0.039	0.0031	$2.9 \times 10^{-4}$	$3.8 \times 10^{-4}$	0.0019	67.8

**Table 145: Emission Factors for Coal Combustion in an Industrial Boiler**

Boiler Type	Emission Factors (g/MJ coal fired)							
	Hydrocarbons	CO	NO <sub>x</sub>	PM10	SO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub>
Industrial Boiler	0.027	0.23	0.26	0.043	0.52	0.017	0.0019	90

**Table 146: Emission Factors for Diesel Oil Combustion in an Industrial Boiler**

Boiler Type	Emission Factors (g/MJ diesel oil fired)							
	Hydrocarbons	CO	NO <sub>x</sub>	PM10	SO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub>
Industrial Boiler	$6.7 \times 10^{-4}$	0.017	0.020	0.0033	0.0065	$8.3 \times 10^{-5}$	$3.7 \times 10^{-4}$	76.2

**Table 147: Emission Factors for Heavy Fuel Oil Combustion in an Industrial Boiler**

Boiler Type	Emission Factors (g/MJ heavy fuel oil fired)							
	Hydrocarbons	CO	NO <sub>x</sub>	PM10	SO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub>
Industrial Boiler	$8.6 \times 10^{-4}$	0.015	0.051	0.0058	0.15	0.0031	$3.4 \times 10^{-4}$	78.4

**Table 148: Emission Factors for Natural Gas Combustion in an Industrial Flare**

Boiler Type	Emission Factors (g/MJ natural gas fired)							
	Hydrocarbons	CO	NO <sub>x</sub>	PM10	SO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub>
Utility/Industrial Boiler	0.06	0.16	0.029	0	0.68	--	--	56.5